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**RESULTS OF THE F/H EFFLUENT TREATMENT FACILITY
BIOLOGICAL MONITORING PROGRAM, JULY 1987-JULY 1991 (U)**

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INTRODUCTION

As required by the South Carolina Department of Health and Environmental Control (SCDHEC) under NPDES Permit SC0000175, biological monitoring was conducted in Upper Three Runs Creek to determine if discharges from the F/H Effluent Treatment Facility have adversely impacted the biotic community of the receiving stream. Data included in this summary report encompass July 1987 through July 1991.

The F/H ETF was designed to treat wastewater at the rate of 235 gpm. Due to a reduction in process operations in F and H Areas, the F/H ETF has never operated at more than about 25% of design capacity and it is not anticipated that the F/H ETF will operate at more than 25% of design capacity in the foreseeable future.

As originally designed, the F/H ETF was not expected to remove all of the mercury from the wastewater; therefore, SCDHEC specified that studies be conducted to determine if mercury was bioaccumulating in aquatic biota. Subsequent to approval of the biological monitoring program, an ion exchange column was added to the F/H ETF specifically to remove mercury, which eliminated mercury from the F/H ETF effluent.

DESCRIPTION OF THE MONITORING PROGRAM

In order to collect preoperational baseline data, the biological monitoring program was initiated in July 1987, approximately 15 months prior to the start-up of the F/H ETF on October 31, 1988. Five sampling stations were selected, with one located upstream from the F/H ETF outfall, one in the mixing zone, and three stations located downstream from the mixing zone.

From July 1987 until February 1990, macroinvertebrates were sampled quarterly at each sampling station using Hester-Dendy multiplate samplers (five replicates per station). In addition, macroinvertebrates were collected from natural substrates at each station semiannually in order to collect taxa that are generally not found on artificial substrate samplers.

Toxicity tests (Ceriodaphnia dubia 7-day reproductive impairment) were conducted on the F/H ETF effluent on a quarterly basis, and NOEC's and LOEC's were determined.

Because it was originally anticipated that the F/H ETF effluent might contain measurable concentrations of mercury, hydropsychid caddisflies were sampled for mercury bioaccumulation.

In addition, water samples were collected monthly at each station and analyzed for 31 parameters (Table 1). Water samples were also collected weekly for NPDES compliance and the results were submitted to SCDHEC in the monthly Discharge Monitoring Reports. The results of the NPDES sampling are not discussed in this summary report, since the NPDES sampling is not part of the biological monitoring program.

Beginning in March 1990, with concurrence from SCDHEC (letter from C.C. Montgomery to S.R. Wright, January 2, 1990), the sampling program was reduced from five stations to three, with one station located upstream from the F/H ETF outfall (Station 1), one station located in the mixing zone (Station 2), and one station located approximately 3 km downstream from the outfall (Station 5; Figure 1). In addition, the frequency of water sampling was reduced from monthly to quarterly, and mercury bioaccumulation studies were conducted on the dusky shiner instead of a caddisfly.

RESULTS

Water Chemistry

The water chemistry of Upper Three Runs Creek is typical of many coastal plain blackwater streams. The water is very soft (approximately 10 mg/l hardness as CaCO_3), and poorly buffered (alkalinity <3 mg/l). The addition of the F/H ETF effluent to Upper Three Runs Creek has resulted in very slight increases in specific conductance, alkalinity, sodium, and nitrate in the stream. Specific conductance in Upper Three Runs has increased by approximately 2 umhos/cm, alkalinity has increased by about 0.3 mg/l, sodium has increased by about 0.3 mg/l and nitrate-nitrogen has increased by about 0.06 mg/l. None of the increases are substantial enough to result in any degradation of the stream ecosystem. None of the metals known to be present in the influent of the ETF were found to be present in the effluent at concentrations above those of the receiving stream, and based on water chemistry, no impact to the receiving stream would be expected from the F/H ETF effluent.

Macroinvertebrate Community

The macroinvertebrate data indicate that Upper Three Runs Creek supports very similar macroinvertebrate communities upstream and downstream from the F/H ETF outfall. The macroinvertebrate community is diverse and productive, and there is no evidence that the F/H ETF has adversely affected macroinvertebrates in the stream. Some temporal changes were observed in the macroinvertebrate community over the course of four years, but the changes cannot be attributed to the F/H ETF, since similar changes were observed upstream and downstream from the discharge.

Toxicity Tests

Under average and 7Q10 stream discharge conditions, Upper Three Runs Creek dilutes the F/H ETF effluent by factors of 1:370 (0.27% effluent) and 1:225 (0.44% effluent), respectively. The results of the 7-day Ceriodaphnia dubia survival and reproduction toxicity tests that were conducted quarterly all indicate that no toxicity would be expected after the effluent is mixed with the receiving stream. The NOEC was most often 30% effluent, although on one occasion, an NOEC as low as 1% effluent was reported.

In general, the toxicity of the effluent has decreased over time. During the last 18 months of sampling, the NOEC was 30% effluent in 5 of the 6 tests and 3% effluent for the remaining test.

Mercury Bioaccumulation

The results of the mercury bioaccumulation studies conducted on hydropsychid caddisflies (Enwright, 1988b) and dusky shiners (Newman, 1992) prior to start-up of the F/H ETF indicate that there was no difference in tissue concentrations of test organisms collected upstream and downstream from the site of the ETF outfall. Mercury analyses conducted on the dusky shiner subsequent to the start-up of the F/H ETF (Newman, 1992) indicate some seasonal differences in mercury concentrations, but no evidence of increased mercury bioaccumulation in fish inhabiting Upper Three Runs Creek downstream from the F/H ETF outfall.

CONCLUSIONS

The results of the biological monitoring program indicate that at the present rate of discharge, the F/H ETF effluent has not adversely affected the receiving stream with respect to any of the parameters that were measured. The effluent is not toxic at the in-stream waste concentration and there is no evidence of mercury bioaccumulation.

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